DOCUMENT RESUME

ED 026 139 PS 001 532

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Acquistion and Transfer Differences between Kindergarteners and Second-Graders on Aurally and Visually Presented Paired-Associates Using an A-B, A-C Design Research Project Number 2 of Project Head Start Research and Evaluation Center, Syracuse University Research Institute. Final Report, November 1, 1967.

Syracuse Univ., N.Y. Research Inst.
Spons Agency-Office of Economic Opportunity, Washington, D.C.
Report No-OEO-4010
Pub Date 1 Nov 67
Note-12p.
EDRS Price MF-$0.25 HC-$0.70
Descriptors-*Age Differences, *Aural Stimuli, Cognitive Development, *Comparative Analysis, Control Groups, Experimental Groups, Grade 2, Kindergarten Children, *Paired Associate Learning, Preschool Learning, *Visual Stimuli

Sixty kindergarten and sixty second grade children were administered a paired-associate (P-A) task. The subjects in each age group were randomly assigned to one of four groups: (1) experimental with aural presentation of the P-A's, (2) experimental with visual presentation of the P-A's, (3) control with aural presentation of the P-A's and (4) control with visual presentation of the P-A's. An AB-AC paradigm was used. Each of the two P-A lists of this study was composed of five word-pairs or five picture-pairs. The first list presented to the subject was repeated until one perfect anticipation trial was performed, and then the second list was presented for nine trials. The results showed that children reached criterion significantly faster in the visual presentation groups. It was also found that the younger children showed less negative transfer in the AB-AC design than the older children. (WD)

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Project Head Start Research
and Evaluation Center
Contract # OEO 4010
November 1, 1967

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Acquisition and Transfer Differences Between Kindergarteners and Second-graders on Aurally and Visually Presented Paired-associates Using an A-B, A-C Design

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Acquisition and Transfer Differences Between Kindergarteners and Second-graders on Aurally and Visually Presented Paired-associates Using an A-B, A-C Design

Vernon C. Hall*

As Jensen and Rohwer (1965) point out, many conceptions about the learning process might be considerably different if psychologists had used subjects other than college sophomores in rote learning experiments. It is interesting that while many psychologists hypothesize developmental changes (be they maturationally or experientially based) in other areas, rote learning has until recently been both theoretically and empirically neglected. The present study was carried out to extend our knowledge about developmental differences in paired-associate learning. More specifically, this experimenter was concerned with the effects of mode of presentation on acquisition and interference with kindergarten and second-grade children.

In an earlier article Loomis and Hall (in press) using the aural mode of presentation employed the A-B, A-C design with kindergarten and second grade children. They found significant interference effects with the 8-year-olds but not the 5-year-olds. This was not only contrary to White's (1965 p. 214) prediction that 5-year-olds should exhibit significantly more negative interference but also fails to demonstrate a well-known phenomenon found many times with adults. This clearly demanded replication with a new sample. In addition, most studies unilizing the A-B, A-C paradigm have used visual presentation and it was felt that adding the visual mode here would considerably increase our knowledge about the

* The author would like to thank Arlene Blake and Richard Kingsley for their valuable assistance.

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generality of the Loomis and Hall findings. The Loomis and Hall study also used a double criterion (15 trials or 1 perfect trial) for its measurement of transfer effects and running everyone the same number of trials should again increase our confidence in the results. Finally, an additional pair was added to the lists (from four to five) since it was found that the younger children were easily able to handle this many.

With regard to acquisition, it has typically been reported that young children perform better with aural than visual presentation (i.e., McGeoch and Irion, 1952). Budoff and Quinlan (1964a) using 8 pairs of nouns and verbs from preprimers (some of which formed meaningful combinations; i.e., look - dog) found that 7 and 8-year-olds learned the lists significantly faster when presented aurally. They also used the double criterion of 1 perfect trial or 24 trials. Later, the same experimenters (1964b) replicated these findings using average and retarded readers with the same materials and procedures. Otto (1961) paired five common forms (i.e. triangle) with low association value trigrams which he presented to three grade levels (2, 4 and 6) of good, average and poor readers. Here the differences between procedures used in aural and visual presentation (he calls them re-inforcements) modes are less pronounced (in both conditions the cvc was articulated but the visual condition included presentation of the three letters). Here, again, the second-graders (but not fourth and sixth) were better at the aural than visual presentation. There was an added problem, however, in that both serial order and scrambled order were used and the subject was run until he reached one perfect trial in each presentation type.

In no case have experimenters used kindergarten children or pictures rather than words in comparing visual with aural presentations. Since as White (1965)

has pointed out, the age range between 5 and 7 has been identified by several theorists and much empirical data as being a transitional stage for learning processes, it is especially appropriate for any study interested in early developmental changes to include this age span. With regard to the pictures rather than words, not only is it impossible to use the latter with kindergarten children but it seems more appropriate to use pictures with second-graders since ability to read might well be a confounding factor when making a comparison with the aural presentation..

Method

Design and Sample. The basic design compared two age levels (kindergarten and second grade), two modes of presentation and two paradigms; (experimental and control). Subjects were 60 kindergarteners randomly chosen from approximately 120 kindergarteners and 60 second graders randomly chosen from about 125 students at Wetzel Road Elementary School, Liverpool, New York. The mean ages were 6.1 and 8.2. The subjects in each age group were randomly assigned to one of the four groups (aural or visual; experimental or control), which left 15 subjects in each cell.

Materials and Procedures. The lists used are shown in Table 1 and were nouns randomly selected from the 45 singular nouns used as stimuli in gathering the oral word association norms from young children by Palermo and Jenkins (1966). Outline drawings of the objects these words represented were then made, photographed and reproduced as 35mm slides. These slides were projected on a 9 inch by 9 inch screen (See Figure 1) by a Sawyer 707Q slide projector. The projector was operated automatically by two Hunter Timers. The first object was presented for 3 seconds by itself and then the two objects were shown together for three seconds. The inter-trial interval was 6 seconds.

Aural presentation was recorded on a Magnicord 1140 Tape recorder and presented to the children via Sharpe earphones. The stimulus word was first pronounced and then after a three second pause it was pronounced again with the response word. Both modes were in all other details identical. The actual lists were arranged in five random orders with the limitation that no single pair was to occur consecutively. This was violated on trial ten where the circular tray on the slide projector recycled and the last pair on trial nine was the same as the first pair on trial ten.

Prior to the experimental task, each subject was presented a two-pair list (knife-fork and ice cream-cake) to a criterion of one perfect trial to be sure the children understood the instructions. The instructions seen below were adapted from McCullers (1963).

> This is a game to see how well you can learn. If you try real hard we will give you some M and M candy afterwards. This is how it goes. When I turn on this slide projector (tape recorder) you will see (hear a word) an object. A few seconds later you will see (hear) the same object (the same word) with another object (word). Your job is to guess what the second object (word) will be, before you see (hear) it. You are to say the name of the object (word) out loud so I can hear you. Although the objects are all very common, I will tell you what we call them the first time through if we happen to call them different things. Here is an example of what you are going to see (hear). (1 trial with the two pair list) O.K. now we are ready to start (Present the two pair list until the subject gets one perfect trial and then clarify instructions if necessary.)

The underlined sentence was only used in the visual condition. Other condition differences are in parenthesis and should be self evident. The candy was used to keep the attention of the children and each subject received 4 M and M candies upon completion of the task.

All subjects repeated the first list until one perfect anticipation trial was performed and then immediately shifted to the second (within 30-60 seconds). The second list was presented to all subjects for 9 trials. Table 1 shows the lists used.

RESULTS

A 2 (experimental-control) x 2 (kindergarten-second grade) x 2 (audio-visual) analysis of variance was computed on trials to criterion on the first list. This analysis yielded a significant visual-audio effect ($F = 5.11$, 1/112 df, $p < .05$) and a significant experimental-control interaction with kindergarten and second grade. Examination of Table 2 which shows the appropriate means and standard deviations indicates that children reached criterion on the list significantly faster when it was visually presented. The interaction was caused by the kindergarten controls doing better than the experimental group while the second grade controls did not do as well as the experimental group. No other interactions or main effects were significant.

The second list was initially analyzed using a 2 (experimental-control) x 2 (aural-visual) x 2 (kindergarten-second grade) analysis of variance using a number of correct anticipations. This analysis yielded a significant experimental-control effect ($F = 8.69$, 1/112 df, $p < .01$) with no other main effects or interactions reaching significance. Subsequently two separate 2 (experimental-control) x 2 (aural-visual) analysis of variance were computed for each grade. The kindergarten analysis failed to yield any significant main effect or interaction. The second grade analysis yielded a significant experimental-control effect ($F = 7.98$, 1/56 df $p < .01$). The aural-visual main effect was not significant ($F = 3.55$, 1/56 df, $p < .05$). The appropriate means and standard deviations are shown in Table 3.

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DE	AB	AC
doctor-chair	house-gun	house-bread
table-hammer	finger-woman	finger-sheep
bed-dog	needle-cheese	needle-girl
spider-man	lion-scissors	lion-boy
hand-lamp	baby-car	baby-mountain

Table I. Word List used.

X	KV	KΛ	SV	SΛ
E	7.2 / 4.57	7.8 / 3.95	7.4 / 3.45	8.1 / 4.67
C	7.2 / 2.94	11.2 / 5.52	5.7 / 2.49	6.4 / 3.49

Table II. Means and standard deviations for number of trials to criterion for first set.

	KV	KA	SV	SA
E	20.87 / 10.50	23.33 / 8.24	24.67 / 8.71	23.0 / 10.31
C	25.33 / 8.95	27.33 / 6.84	33.33 / 6.99	26.73 / 7.59

Table III. Means and s.d. of number correct on trials 2-9 on second set.

Discussion

Although it is, of course, impossible to exactly equate the two modes of presentation, the writer felt that by using pictures rather than printed words and earphones rather than free field he had come closer than previous attempts. The present writer also feels that in light of these findings the earlier generalization (McGeoch and Irion, 1952; Budoff and Quinlan, 1964a) that children learn faster aurally than visually must be modified. It seems possible that the conditions under which different modes excell may be quite specific with both subject and task parameters in need of further investigation.

The fact that 5-year-olds show no significant negative transfer in the A-B, A-C design has now been replicated three times (the present article, Loomis and Hall, in press, and an unpublished pilot study) with the audio mode. The addition of one more pair and the visual mode of presentation in the present study adds to our confidence that this is indeed a generalizable phenomenon. When we add this to the fact that other studies using this age group (i.e., Koppenaal, Krull and Katz, 1964; Jensen and Rohwer, 1965) have also found the 5-year-olds to perform differently from older children, the present author believes a case is made for asking psychologists interested in paired associate learning to give this age group more theoretical attention. Maybe the most pressing problem concerns the question of whether this is a maturational or experiential effect. The tendency so far, has been to try and account for it through experience (i.e., Koppenaal, Krull and Katz suggest amount of remote prior learning) and it is also the preference of the present experimenter. On the other hand, this still leaves unanswered the question of why most children acquire the correct amount of experience to behave like college students between the ages of 5 and 7. Since all children in these studies have been in some kind of school at time of testing and the present

experiment was done in the latter half of kindergarten, after some formal instruction had begun, the effect of school may be less important than often represented.

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